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ABSTRACT

Fifty-five college students were assessed on four types of cognitive and metacognitive measures in math, language, and visual/spatial tasks. They were measures on self-reported general metacognitive skills, predicted performance, metacognitive behaviors, and actual performance. The students' self-reported assessments of their ability on a general and specific level were positively correlated with their performance on the problem solving tasks. Students' successful performance were positively correlated with knowledge-based metacognitive behaviors. On predicted performance, students were more accurate in predicting their performance on math and language tasks. On visual/spatial tasks, there was a tendency for the students to overpredict their performance. It was concluded that college students' self-reported assessments of their own ability on a general and specific level in problem solving tasks were good indicators of their level of performance on such tasks. Successful performance was not dependent on the amount of cognitive monitoring per se, but on the type of strategies used. The accuracy of prediction was associated not only with one's ability but it varied with the task as well. (Author)

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Assessing Metacognitive Skills in Problem Solving

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Abstract

Fifty-five college students were assessed on four types of cognitive and metacognitive measures in math, language, and visual/spatial tasks. They were measures on self-reported general metacognitive skills, predicted performance, metacognitive behaviors, and actual performance. The students' self-reported assessments of their ability on a general and specific level were positively correlated with their performance on the problem solving tasks. Students' successful performance were positively correlated with knowledge-based metacognitive behaviors and negatively correlated with regulatory metacognitive behaviors. On predicted performance, students were more accurate in predicting their performance on math and language tasks. On visual/spatial tasks, there was a tendency for the students to overpredict their performance. It was concluded that college students' self-reported assessments of their own ability on a general and specific level in problem solving tasks were good indicators of their level of performance on such tasks. Successful performance was not dependent on the amount of cognitive monitoring per se, but on the type of strategies used. The accuracy of prediction was associated not only with one's ability but it varied with the task as well.

Statement of the Problem

Performance on problem solving is not only determined by pure cognitive knowledge and behaviors but by the knowledge about these cognitions and the regulation of these cognitions and behaviors. The latter type of knowledge is a phenomenon known as "metacognition" (Flavell, 1978). Most metacognitive researchers are concerned with developmental studies on memory (Flavell, 1975; Flavell & Wellman, 1977; Kreutzer, Leonard, & Flavell, 1975), reading (Brown, Smiley, & Lawton, 1978; Danner, 1976; Yussen, Mathews, & Hiebert, 197), and learning disabilities (Brown, Campione, & Barclay, 1979). In problem solving, studies on metacognitive skills are still quite scarse.

One method of identifying metacognitive skills was by finding out how a person assessed his own ability as a learner, the nature of the task, and the strategies used on the task (Flavell, 1978; 1979). Studies supporting this position found that a person with good metacognitive skills predicted one's performance on a task accurately (Flavell, Friedrich, & Hoyt, 1970), differentiated the relevant from the irrelevant information (Markman, 1977), and identified the tasks that required specific types of strategies (Kreutzer et al., 1975).

Another method of identifying metacognitive skills was by using a model of problem solving to analyze metacognitive behaviors (Lester & Garofalo, 1982). The model incorporated five categories of problem solving processes which were affective processes, orientation processes, organization, execution, and verification. Observations and interviews on the use of these processes revealed that children's problem solving behaviors were mostly concentrated on computation strategies.

One more method of identifying metacognitive skills was by analyzing

two-person protocols (Shoenfeld, 1982). Three types of analysis were used to interpret the verbal data obtained from the participants while solving a geometry problem. The analysis of tactical knowledge included facts, procedures, domain specific knowledge, and heuristics. The analysis of control behaviors included strategic behaviors and conscious metacognitive behaviors. The analysis of belief systems included conscious and unconscious forces which determined problem solving behaviors. Shoenfeld's study found that students' strategies in solving geometry problems were controlled by acquired belief systems about the discipline. For example, solutions to problem tasks should be supported by rigorous mathematical proof.

A comparison of the three ways of assessing metacognitive skills showed that the three methods overlapped in the way they assessed metacognitive skills. Among these method, Flavell's position gave a more comprehensive and balanced treatment of the various types of cognitions and behaviors. However, studies supporting this position were conducted in a fragmented fashion by dealing with only one metacognitive variable at a time.

The purpose of this study was to assess more comprehensively the metacognitive skills used in three different types of problem solving tasks by using self-report measures and systematic observations in determining the relationships among the outcomes of these methods. This study also looked at the importance of metacognitive processes in determining learning outcomes. This was accomplished by finding the relationships among the metacognitive measures and actual performance on the three different types of problem solving tasks.

The following questions were addressed in this study.

1. What are the degrees of relationships among the different metacogni-

tive measures obtained in three different types of problem solving tasks?

2. What are the degrees of relationships among the metacognitive measures and actual performance?

Methods

Materials

Four types of instruments were formulated to generate four types of cognitive and metacognitive measures on three different types of problem solving tasks.

1. The Self-Report Inventory of Metacognitive Skills was designed to measure a person's assessment of his own general metacognitive ability in solving math problems, language problems, and visual/spatial problems. The results on this measure were referred to as the self-reported metacognitive skills scores.

2. The Questionnaire on Specific Problem Solving Tasks was designed to measure a person's ability to assess the difficulty level of specific math, language, and visual/spatial problems and to predict one's performance on such tasks. The results on this measure were referred to as the predicted performance scores.

3. The Inventory of Metacognitive Behaviors During Problem Solving was designed to classify the kind of metacognitive behaviors during problem solving and to determine the amount of each kind of metacognitive behavior used in actual problem solving situations. The inventory was completed by an external observer and the ratings were referred to as metacognitive behavior scores.

4. The Problem Solving Tasks consisted of three sets of problems with three problem tasks in each set on math, language, and visual/spatial.

The results on these tasks were referred to as the actual performance scores. (On the instruments listed see Appendices A - D)

Procedure

The investigation consisted of two parts; the pilot study and the main investigation. The purposes of the pilot study were to determine the test-retest reliability and internal consistency of the Self-Report Inventory of Metacognitive Skills and the interrater reliability of the Inventory of Metacognitive Behaviors During Problem Solving.

In the main study fifty-five students from the introductory Special Education and Psychology classes volunteered to participate in exchange for two points added to their grade in the course. The subjects reported for the main session individually.

The session was started by administering the Self-Report Inventory of Metacognitive Skills. After the subject finished, the problem tasks were presented on the screen one at a time from 35 - 60 seconds depending upon the length of the problem. The three types of problems were presented following a Latin Square sequence. The subject was asked to read and understand the problem well. After reading each problem, the subject was asked to assess the difficulty level of the problem and to predict one's performance on the task by responding to the Questionnaire on Specific Problem Solving Tasks.

On the last activity, the same problems were presented one set at a time in a Latin Square order of presentation. The subject was asked to actually solve the problem one set at a time with a time limit of 15 minutes per set. After a set was given, the subject was left alone in the room. The investigator came back after each time limit was over.

During the problem solving activity, two raters observed the subject's metacognitive behaviors through a one way mirror. They rated the subject's behaviors according to the Inventory of Metacognitive Behaviors During Problem Solving and recorded their observations on a scoring sheet every ten seconds. The raters were the investigator herself and a graduate student in psychology. Both raters were highly familiar with the procedure. The investigator explained how the problem solving behaviors were classified and what codes were used in recording the observations.

After all sets were solved, the session was terminated by thanking the subject for participating.

Design

Intercorrelations among the different cognitive and metacognitive measures were calculated. The correlations included self-reported metacognitive skills x predicted performance, self-reported metacognitive skills x actual performance, and predicted performance x actual performance. The metacognitive behaviors scores were grouped under three categories namely knowledge-based strategies, regulatory strategies, and referential strategies. These three categories were intercorrelated with self-reported metacognitive skills, predicted performance, and actual performance. In addition the relationships between these three categories and the time used in solving each set of problems were also analyzed.

The relationships between predicted performance and actual performance was further analyzed to see if there were differences in the accuracy of prediction among math, language, and visual/spatial tasks. The accuracy of prediction was determined by categorizing the actual performance scores

as accurately or inaccurately predicted scores. These categorizations were done separately for math, language, and visual/spatial scores. A score was accurately predicted when the subject's response on the Questionnnaire on Specific Problem Solving Tasks was high and the corresponding actual performance score on the problem task was right or when the response was low and the corresponding actual performance on the problem task was not right. A score was inaccurately predicted when the subject's response to the questionnaire was high and the corresponding actual performance on the problem task was not right or when the response was low and the corresponding actual performance on the problem task was right. The accurately predicted scores in math, language, and visual/spatial tasks and their corresponding total predicted performance scores were correlated.

Results

Reliability estimates on the instruments used showed the Self-Report Inventory of Metacognitive Skills had a test-retest reliability of .86 and an internal consistency reliability of .70. The interrater reliability on the Inventory of Metacognitive Behaviors was analyzed separately for each of the ten criteria. The interrater agreement on the ten criteria was on the average .83. The interrelationships among the cognitive and metacognitive measures are clearly described in a matrix (See Appendix E).

On the Self-Report Inventory of Metacognitive Skills, the correlation between self-reported metacognitive skills and predicted performance was $r = .50$, between self-reported metacognitive skills and actual performance $r = .46$, and between predicted performance and actual performance $r = .37$.

All three correlations were significant on a $p < .01$ level.

On the metacognitive behaviors the knowledge-based strategies did not correlate significantly with self-reported metacognitive measure $r = .20$. The frequency of the use of knowledge-based strategies correlated positively with predicted performance $r = .28$, $p < .05$ and actual performance $r = .27$, $p < .05$. The regulatory strategies correlated negatively with self-reported metacognitive skills $r = -.33$, $p < .05$, predicted performance $r = -.45$, $p < .01$, and actual performance $r = -.27$, $p < .05$. The referential strategies correlated positively with predicted performance $r = .36$, $p < .01$, but did not correlate significantly with self-reported measure $r = .26$ and actual performance $r = .10$.

The relationships among the different categories of metacognitive behaviors and the total time used for monitoring metacognitive behaviors while solving all the problem sets were determined. Knowledge-based strategies did not correlate significantly with the total time used $r = -.20$. The regulatory strategies correlated positively with total time $r = .51$, $p < .01$. The referential strategies correlated negatively with the total time $r = -.47$, $p < .01$. When total time was broken down into the amount of time used for math, language, and visual/spatial problem sets, the knowledge-based category correlated negatively with math time $r = -.30$, $p < .05$. It did not correlate with language time $r = -.19$ and visual/spatial time $r = .00$. The regulatory category correlated positively with math time $r = .46$ and language time $r = .51$. Both correlations were significant on $p < .01$. It did not correlate with visual/spatial time $r = .17$. The referential category correlated negatively with math time $r = -.29$, $p < .05$ and language time $r = -.47$, $p < .01$, but did not correlate significantly with visual/spatial time $r = -.22$. The various time x metacogni-

tive behaviors relationships are presented in a matrix (See Appendix F).

The correlations between predicted performance scores and actual performance scores were: on math tasks $r = .35$, $p < .05$, on language tasks $r = .25$, and on visual/spatial tasks $r = .14$ (See Appendix G). The correlations between accurately predicted scores and predicted performance scores on the different types of problem solving tasks were: on math $r = .42$, $p < .01$, on language tasks $r = .47$, $p < .01$, on visual/spatial tasks $r = -.36$, $p < .01$ (See Appendix H).

Discussion

The positive correlations among the metacognitive measures confirmed the hypothesis that relationships existed among certain types of metacognitive skills in problem solving. College students' self-reported assessments of their own general ability on problem solving tasks were good indicators of their ability to predict accurately their actual performance on specific problem solving tasks. The results partially supported Flavell's theory (1978; 1979) that a person with good metacognitive ability had a better knowledge about his own general ability on a specific area of knowledge and a better assessment of the task presented which resulted in better actual performance on the task. In this study, only certain types of cognitive strategies could be associated with better metacognitive skills and successful performance on certain types of problem solving tasks.

On the different categories of metacognitive behaviors, students with higher estimates of their own general ability utilized more knowledge-based and referential strategies and less regulatory strategies. Vice versa, the lower the estimates of one's ability, the lower the

knowledge-based and referential strategies, the higher the regulatory strategies. Similarly students with higher confidence estimates of their performance and actual performance utilized more knowledge-based and less regulatory strategies. High predictors used more referential strategies.

The amount of cognitive monitoring used can be further substantiated by the amount of time used for each metacognitive behavior category while solving the problems. On math problems, the more knowledge-based and referential strategies, the less regulatory strategies, the less time was used. Vice versa, the less knowledge-based and referential strategies, the more the regulatory strategies, the more time was used. On language problems, the less the regulatory strategies, the more the referential strategies, and the ~~more~~ less time was used. Time was not utilized as much for knowledge-based strategies as on math problems. On visual/spatial problems, the lack of time trend for any of the strategies used was probably due to the fact that these problems were more difficult for the subjects to solve. Subjects who were unable to solve the problems either got easily frustrated and gave up or they solved the problems persistently.

The utilization of metacognitive behaviors in problem solving supported the product-process rationale that successful performance was dependent upon the appropriate selection and regulation of certain cognitions on specific problem solving tasks. In this study, performance was not dependent upon the amount of cognitive monitoring per se, but more on the efficient use of accessible knowledge and external aids such as notes, diagrams, and charts in solving the problems. Furthermore, cognitive monitoring on a mere regulatory level was useless if it was not backed up by a broad knowledge base and referential aids to learning. This finding also supported the view that successful problem solving was based

on an extensive and accessible knowledge (Silver, 1982).

On predicted performance, college students could predict their performance on math problems better than on language and visual/spatial problems. However, these results could be misleading. Certain metacognitive abilities could have been masked up if the analysis were limited to just finding the relationships between predicted performance and actual performance. In comparison to the above findings, further analysis of accurately predicted scores showed that college students had better predictive ability on math and language tasks than on visual/spatial tasks. On math and language problems, students who predicted higher about their performance were more accurate in their prediction than those who predicted lower about their performance. On visual/spatial tasks, students who predicted higher about their performance were less accurate in their prediction. The results partly agreed with previous findings that people with better metacognition predicted their performance on tasks better than those with poor ones (Flavell et al., 1970). At this point, we would like to extend further the idea that in problem solving, prediction was not only a function of ability but also of the task presented. Students' predictive ability was better on complex tasks that were more familiar to them. For uncommon ones such as the visual/spatial tasks, there was a tendency for students to overpredict their performance. It was possible that poor performance on such task was due to the absence of domain specific knowledge and executive control behaviors (Shoenfeld, 1982).

In conclusion: (a) the self-reported assessment of one's ability on a general as well as specific level is a good indicator of one's level of performance on specific problem solving tasks; (b) the accuracy of

prediction about one's level of performance on a particular problem task was associated not only with one's ability but it varied with the task as well; (c) successful performance does not depend on the amount of cognitive monitoring per se, but on the type of metacognitive strategies utilized; (d) metacognitive behaviors are futile if they are not associated with a broad knowledge base on the task.

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Appendix A

Self-Report Inventory of Metacognitive Skills in Problem Solving

Instruction

The statements in this inventory are used to find out how people perceive their own abilities and performance on problem solving tasks and the nature of the problem solving tasks. Answer them according to what you actually think and do and do not answer them according to what you think you should do. Respond as accurately as you can.

Appendix B

A Questionnaire on Specific Problem Solving Tasks

Direction: Circle your answers. Give your best guess if you are uncertain about how to respond.

Questions:

1. How well can you solve this problem?

   Very well Good Fair Poor

2. How confident are you in your estimate of your performance?

   Very Confident Confident Less Confident Not Confident At All

3. In a scale of 1 - 4 (4 as very difficult) how difficult is this problem for you?

   Very Easy Easy Difficult Very Difficult

A. On a scale of 1 - 7 (from poor to excellent) rate yourself in solving three different types of problem solving tasks. Circle the number you choose to rate yourself.

1. Mathematical Problems - These may involve problems such as adding, subtracting, multiplying, and dividing numbers, converting ounces to pounds, finding the right number in a series (3, 6, 12, 24 .....) or classifying data.

1	2	3	4	5	6	7
Very Poor	Poor	Fair	Good	Very Good	Superior	Excellent

2. Language Problems - These may involve problems such as solving crossword puzzles, guessing riddles, interpreting directions, detecting missing or ambiguous information, classifying concepts and ideas, or learning a new language.

1	2	3	4	5	6	7
Very Poor	Poor	Fair	Good	Very Good	Superior	Excellent

3. Visual/Spatial Problems - These may involve problems such as solving mazes, puzzles, chess, mastermind, constructing objects by following a diagram, or solving simple problems on geometric shapes and areas.

1	2	3	4	5	6	7
Very Poor	Poor	Fair	Good	Very Good	Superior	Excellent

B. Rate yourself on the following items by circling the number as indicated by the code below.

1. Always
2. Often
3. Sometimes
4. Seldom
5. Never

*1. I find it difficult to grasp visual/spatial problems like using a visual diagram to put together a home appliance or visualizing how a room will look after the furnishings have been changed.

1 2 3 4 5

*2. I find it difficult to visualize geometric contents such as estimating the number of blocks in a pile when some of them are not in view.

1 2 3 4 5

3. I can more or less estimate closely what the solution would be after reading a language problem.

1 2 3 4 5

4. I can closely estimate the solution to a math problem before doing all of the calculations.

1 2 3 4 5

*5. I am often at a loss for words if someone asks me for help in solving language problems, like supplying a word in a cross-word puzzle.

1 2 3 4 5

6. I can estimate quite accurately how I did on an exam.

1 2 3 4 5

7. I often have a strong intuition about whether my answer to a test item is right or wrong.

1 2 3 4 5

*8. I get easily frustrated when I work on block puzzles and similar types of manipulation tasks.

1 2 3 4 5

9. I often feel disorganized when a large amount of numerical information is presented to me at one time.

1 2 3 4 5

10. I usuallu break down long problems into shorter units to be able to interpret them better.

1 2 3 4 5

*11. In object assembly tasks, like putting a bicycle together, I have the habit of trying out things first and reading the instructions only after I make a mistake.

1 2 3 4 5

12. When my first attempt at a problem does not work, I usually try a couple of other approaches before giving up.

1 2 3 4 5

*13. In an exam, I often spend too much time on difficult problems and neglect the rest of the problems.

1 2 3 4 5

14. I make it a point to write symbols and data carefully and accurately to avoid errors.

1 2 3 4 5

15. I make it a point to take good notes in class.

1 2 3 4 5

16. If I am not sure if my procedures or solutions are right, I usually consult people and other sources.

1 2 3 4 5

*17. I usually do not bother reviewing my work before I turn my paper in on an exam.

1 2 3 4 5

18. When taking an exam, I usually work on easy items first and then go to the more difficult ones rather than just taking them in the order they are presented.

1 2 3 4 5

* Reversed Items

Appendic C

An Inventory of Metacognitive Behaviors During Problem Solving

1. Rereads the problem.
2. Copies numeric data or phrase uints.
3. Does calculations using numeric values stated in the problem.
4. Draws diagrams, tables, or charts to categorize data or information.
5. Classifies or tallies numeric data or idea units.
6. Recalculates solution or verifies recorded data or idea units with the problem.
7. Tries out another solution.
8. Looks at the watch or checks on time limit.
9. Supply missing or implied information.
10. Engages in other strategic or information search behaviors such as verbalizing to oneself, counting dots or fingers, tapping pencils, raising one's eyebrows, frowning, closing or moving one's eyes while thinking about the problem mentally.

Knowledge-Based Strategies = Items 2, 3, and 9

Regulatory Strategies = Items 1, 6, 7, and 10

Referential Strategies = Items 4, 5, and 8

Appendix D

Problem Solving Tasks

A. Math Problems

1. The Water Jar Problem :

Imagine yourself to be near a source of water such as a kitchen sink or well. You are given three empty jars. One has a capacity of 14 quarts, the second has the capacity of 163 quarts, and the third has a capacity of 25 quarts, if they are all filled to the top. There are no graduated markings on the jars. Using all or any of these jars, measure 99 quarts of water.

2. The Sandwich Problem:

Paul sold 160 sandwiches for $2.00 each. Each sandwich consisted of 4 oz. og ham, 2 slices of bread, and mustard. Paul paid $3.00 a pound for the ham, 60¢ a loaf for the bread (20 slices per loaf) and used 8 jars of mustard at 50¢ each. How much profit did he make?

3. The Children Problem:

Three fathers -- Pete, John, and Nick -- have between them a total of 15 children of which 9 are boys. Pete has 3 girls and John has the same number of boys. John has 1 more child than Pete, who has 4 children. Nick has 4 more boys than girls and the same number of girls as Pete has boys. How many boys each do Nick and Pete have?

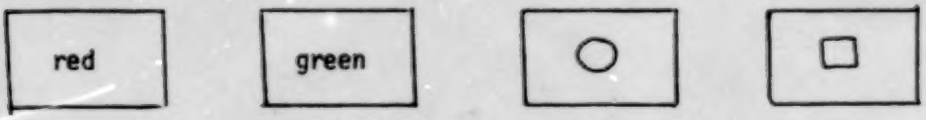
B. Language Problems

1. The Day Problem:

On a certain day I ate lunch at Tommy's, took out two books from the library, visited the museum, and had a cavity filled. Tommy's is closed on Wednesday, the library is closed on Saturday and Sunday, the museum is only open Wednesday, Monday, and Friday, and my dentist has office hours Tuesday, Friday, and Saturday. On which day of the week did I do all these things?

2. Taking Sides Problem:

Given: Four pieces of cardboard. You are told that each one is either red or green on one side, and that each one has either a circle or a square on the other side. They appear on the table as follows:



Which ones must you pick up and turn over in order to have enough information to answer the question, "Does every red one have a square on its other side?"

3. The Foreign Language Problem:

In a foreign language "lev klula buj" means "buy green peppers". However, words in this language are not always spoken in the same order as in English. For example, "buj" does not mean "peppers". Also "ajm buj gyst" means "big green cars" and "ikuka lev ajm" means "quickly buy cars".

How would you say "big peppers" in this language?

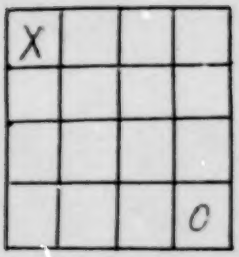
C. Visual/Spatial Problems

1. The Prisoner Problem:

Below is a diagram showing the arrangement of cells in a state prison. One day the prisoner in the cell marked with an "X" went berserk and was overcome with the urge to kill. So he broke through the wall which separted his cell from the one next to it, and murdered the inmate there. This just intensified his madness, so he proceeded to break into each cell and kill the prisoner there. After each was dead, he dropped the body and went on to the next. He would never go back into a cell containing a dead body. Every cell contained a prisoner; he never went through a cell without murdering anyone he found there; and he never broke through an outside wall or a corner.

When the authorities finally arrived, he was just killing the last inmate in the cell marked with an "O". Show the diagram below with a path he might have taken to arrive at that cell last.

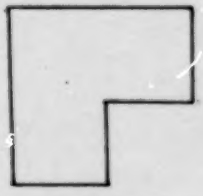
(For diagram see next page.)



2. The Farmer Problem

Once there lived a farmer with four sons. The sons were very jealous of each other and always suspected the father of showing favoritism toward one or the other. So when the time came for him to retire, the farmer was faced with a problem.

He had an odd-shaped piece of land (without buildings) which he decided to divide equally among his sons. He asked you to divide the piece of land shown into four parts equal in size and shape, with none left over. Show how you would do this in the following diagram.



3. The Dot Problem

Connect nine dots with four straight lines without lifting the pencil from the paper.

Appendix E

Table I - The Intercorrelations Among the Cognitive and Metacognitive Skills Scores

	Self Reported Metacognitive Skills Scores	Predicted Performance Scores	Actual Performance Scores	Metacognitive Behaviors Scores		
				K	RG	RF
Self-Reported Metacognitive Skills		.50	.46	.20	-.33	.26
Predicted Performance Scores			.37	.28	-.45	.36
Actual Performance Scores				.27	-.27	.10

N = 55

CV - .01 = .354

.05 = .273

K - Knowledge-based Strategies

RG - Regulatory Strategies

RF - Referential Strategies

Appendix F

Table II - The Intercorrelations Among Time Utilized in Solving Each Problem Set and the Different Categories of Metacognitive Behaviors Scores

	Metacognitive Behaviors Scores		
Time Used	Knowledge Based Strategies	Regulatory Strategies	Referential Strategies
For Math Problems	-.30	.46	-.29
For Language Problems	-.19	.51	-.47
For Visual/Spatial Problems	.03	.17	-.22
Total Time Used for All the Problems	-.20	.51	-.47

N = 55

CV - .01 = .354

.05 = .273

Appendix G

Table III - The Correlations Between Predicted Performance Scores and Actual Performance Scores on Three Different Types of Problem Solving Tasks

	Actual Performance		
	Math Scores	Language Scores	Visual/Spatial Scores
Predicted Math Performance Scores	.35		
Predicted Language Performance Scores		.25	
Predicted Visual/Spatial Performance Scores			.14

N = 55

CV - .01 = .354

.05 = .273

Appendix H

Table IV - The Correlations Between Predicted Performance Scores and Accurately Predicted Performance Scores on Three Different Types of Problem Solving Tasks

	Accurately Predicted Performance Scores		
	Correctly Predicted Math Performance Scores	Correctly Predicted Language Performance Scores	Correctly Predicted Visual/Spatial Performance Scores
Predicted Math Performance Scores	.42		
Predicted Language Performance Scores		.47	
Predicted Visual/Spatial Performance Scores			-.36

N = 55

CV - .01 = .354

.05 = .273